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DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in or relating to Heat Exchangers

We, THE BRITISH PETROLEUM COMPANY LIMITED, of Britannic House, Finsbury Circus, London, E.C.2, a British joint-stock Corporation and NOEL WILLIAM GREY of the aforesaid company's address and of British nationality, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention relates to an improved heat exchanger.

Heat exchangers of the known type, wherein a group of parallel tubes are contained within a casing, heat transfer taking place through the walls of the tubes, have the disadvantage that, in the circulation of fluid with the casing and external to the tubes, there is a tendency to build up deposits on the outside surface of the tubes with consequential reduction in the efficiency of heat transfer.

In a prior proposal for a surface condenser for steam, there is described a condenser having the inlet for the steam arranged as a volute with guide vanes in such a way that the steam obtains a spiral motion through the condenser, hitting the outer tubes all round the set at the same time and with the same velocity this velocity of the steam being maintained as far as practicable throughout the condenser by means of baffles and guide vanes, the steam travelling first inwards towards the centre of the condenser, then outwards, then inwards and so on.

According to the present invention there is provided a heat exchanger having a cylindrical casing containing a plurality of parallel tubes, said tubes being adapted for the passage of fluid and the casing being adapted for the passage of fluid external to the tubes, the casing having at least one inlet, for fluid, at one end of said casing, said inlet being adapted to discharge fluid into said casing in a direction such that said fluid discharged thereby is caused to follow a helical motion, within the casing, to an outlet at the end of the casing remote from the inlet, the longitudinal axis of said inlet being inclined to the plane of a transverse section of said casing.

Preferably a single inlet, fitted with a nozzle by which incoming fluid is directed, and a single outlet are employed.

Preferably the inlet and/or outlet are directed substantially at right angles to the radii of the casing at the points of attachment of inlet and/or outlet respectively. Preferably the outlet is directed to receive the liquid with minimum change in direction of the fluid flow.

The heat exchanger is particularly intended for use of liquid in the casing; the tubes may be employed for the passage of liquid or gas. The heat exchanger may be employed with its axis in any direction, including the horizontal and vertical.

In accordance with the present invention, the fluid within the casing develops helical motion as a result of its direction of introduction and the restraint imposed by the cylindrical inner wall of the casing. Clearly this will require the introduction of the fluid at a flow rate suitable for attaining this result, the flow rate being determinable in any given case by simple experiment. Since the helical motion is developed in the manner described, the use of baffles and/or deflectors within the casing will not be necessary; preferably the heat exchanger is constructed without the provision of baffles or deflectors in the path of the fluid in the casing between inlet and outlet. It is to be understood, however, that by reason the helical motion, the region of the longitudinal axis of the casing will, in use, be free of fluid which, by vortex action, will be thrown towards the casing wall. Within this "dead" space there may be provided at least one tie means, such as a rod or tube, for example a single tube coaxial with the casing, said tie means being used to unite header plates attached to the tube bundle.

Preferably the tubes are arranged on a cir-

cular pitch.

As a result of the manner in which tubes of a heat exchanger, according to this invention, are contacted with fluid, the built-up of deposits within the casing, particularly on the tubes, is reduced.

The invention is illustrated but not limited with reference to the accompanying drawings, in which:

Figure 1 is a sectional elevation along the longitudinal axis of the heat exchanger

Figure 2 is a transverse section across said longitudinal axis at B—B¹, shown in Figure 1.

With reference to Figures 1 and 2:—

A double pass heat exchanger comprises the cylindrical casing (1) containing a plurality of parallel tubes (2a) and (2b), arranged on a circular pitch, between two header plates (3), said header plates being secured together by a central tie tube (4), floating head (5) being welded to the casing. The casing has an inlet (6a) the longitudinal axis of which is inclined to the plane of a transverse section of the casing and an outlet (6b).

In use, fluid enters the casing (1) tangentially, and is caused to follow an helical path along the casing (1), contacting the exterior surfaces of the tubes (2), until it reaches the outlet (6b), which it enters without substantial change of direction.

The head (7) of the heat exchanger is adapted so that a second fluid, which may be the same as, or different to, the fluid in the casing (1) can enter the head by inlet (8) and chamber (9) and thereafter contact the upper tubes (2a). The fluid then passes to chest (10) and thence through the lower tubes (2b), chamber (11) and outlet (12).

The apparatus is designed so that, after removal of the head (7), the plurality of tubes (2a) and (2b), together with the header plates (3) and tie tube (4) may be removed as a single unit, and this unit replaced by an identical unit.

The apparatus rests on supports (13). A drain, not shown, may be fitted to the casing (1).

WHAT WE CLAIM IS:—

1. An heat exchanger having a cylindrical casing containing a plurality of parallel tubes, said tubes being adapted for the through passage of a fluid and the casing being adapted for the passage of fluid external to the tubes, the casing having at least one inlet, for fluid, at one end said casing, said inlet being adapted to discharge fluid into said casing in a direction such that the fluid discharged thereby is caused to follow an helical motion, within the casing, to an outlet at the end of the said casing remote from the inlet, the longitudinal axis of said inlet being inclined to the plane of a transverse section of said casing.

2. An heat exchanger according to claim 1, so adapted that, in use, the fluid in the casing follows an helical path without guidance from vanes, deflectors or baffles.

3. An heat exchanger according to claim 1 or 2, in which the inlet and outlet are directed substantially at right angles to the radii of the casing at the point of attachment of said inlet and outlet respectively.

4. An heat exchanger according to any of the preceding claims having a single inlet for fluid to and a single outlet for fluid from, the casing.

5. An heat exchanger according to any one of the preceding claims, in which the tubes are arranged on a circular pitch.

6. An heat exchanger according to any one of the preceding claims, in which header plates are united by tie means which lie on the longitudinal axis of the casing.

7. An heat exchanger substantially as hereinbefore described and illustrated with reference to the accompanying Figures 1 and 2.

T. MACDONALD,
For the Applicants.

PROVISIONAL SPECIFICATION

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This invention relates to an improved heat exchanger.

Heat exchangers of the known type, wherein a group of parallel tubes are contained within a casing, heat transfer taking place through the walls of the tubes, have the disadvantage that, in the circulation of fluid with the casing and external to the tubes, there is a tendency to build up deposits on the outside surface of the tubes with consequential reduction in the efficiency of heat transfer.

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According to the present invention there is provided a heat exchanger having a cylindrical casing containing a plurality of parallel

tubes; the heat exchanger being adapted for the passage of a fluid through said tubes and of a fluid through said casing and external to said tubes, said casing having at least one inlet, for fluid, at one end of the casing, adapted to discharge fluid into said casing in a direction such that said fluid discharged thereby is caused to follow a helical motion, within the casing, to an outlet at the further end of the casing.

Preferably a single inlet, fitted with a nozzle by which incoming fluid is directed, and a single outlet are employed.

Preferably the inlet and/or outlet are directed substantially at right angles to the radii of the casing at the points of attachment of inlet and/or outlet respectively. With reference to the longitudinal dimension of the casing, the direction of the inlet will be inclined thereto at an angle such that fluid passes from one end of the casing to the other, the outlet being directed to receive the liquid with minimum change in direction of the fluid flow.

The heat exchanger is particularly intended for use of liquid in the casing; the tubes may be employed for the passage of liquid or gas. The heat exchanger may be employed with its axis in any direction, including the horizontal and vertical.

In accordance with the present invention, the fluid within the casing develops helical motion as a result of its direction of introduction and the restraint imposed by the cylindrical inner wall of the casing. Clearly this will require the introduction of the fluid at a flow rate suitable for attaining this result, the flow rate being determinable in any given case by simple experiment. Since the helical motion is developed in the manner described, the use of baffles and/or deflectors within the casing will not be necessary; preferably the heat exchanger is constructed without the provision of baffles or deflectors in the path of the fluid in the casing between inlet and outlet. It is to be understood, however, that by reason the helical motion, the region of the longitudinal axis of the casing will, in use, be free of fluid which, by vortex action, will be thrown towards the casing wall. Within this "dead" space there may be provided at least one tie means, such as a rod or tube, for example a single tube coaxial with the casing, said tie means being used to unite header plates attached to the tube bundle.

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